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AUTHOR Lawler, Mary; And Others
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ABSTRACT

Sixteen adolescents between the ages of 15 and 18 years and their parents participated in a preliminary study on the impact of family and individual factors on diabetes control for the adolescent. It was hypothesized that there was a relationship between the adolescent's perception of adolescent development, social support, depression, family dynamics, stress, and diabetic control. Analysis of the data revealed a significant correlation between depression and diabetic control. Other significant relationships found included those of: (1) family cohesion to depression, family emotional health, social support, and adaptability; (2) emotional triangulation to family adaptability; and (3) family emotional health to social support. Clinical and research implications of the findings are discussed. Twenty-two references are cited. (RH)

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# Individual and Family Factors Impacting Diabetic Control for the Adolescent: A Preliminary Study

Mary K. Lawler, R.N., Ph.D.

Robert Volk, Ph.D.

Nancy Viviani, R.N., B.A.

Mark B. Mengel, M.D., M.P.H.

Department of Family Medicine

University of Oklahoma

Health Sciences Center

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## Abstract

The focus of this preliminary study is on the impact of family and individual factors on diabetes control for the adolescent. Adolescents (n=16) between the age of 15 and 18 and their parents participated in the study. Systems theory formed the theoretical basis for the hypothesis that there is a relationship between the adolescent's perception of adolescent development, social support, depression, family dynamics, stress, and diabetic control. Analysis of the data revealed a significant correlation between depression and diabetic control. Other significant relationships are presented. The clinical and research implications of the findings are discussed.

# Diabetes in Adolescence

The peak incidence of Type I diabetes mellitus, insulin dependent diabetes mellitus (IDDM), occurs in early adolescence. Management of IDDM, therefore, is a life-long task. Unfortunately, only a few adolescents can restore their blood sugar levels to near normal. More intensive methods of treatment have been developed and strict adherence to the diabetic regimen has been emphasized by health care providers. However, even these additional measures have not been satisfactory in improving long-term glucose control for the adolescent with diabetes (Mengel, 1989).

Recent studies have examined contextual issues and their effect upon diabetic control (Mengel, 1989). In particular, two theories have been developed to explain how the diabetic's family may affect diabetic control. The first theory suggests that family dynamics may affect diabetic control by stimulating the secretion of counterregulatory (stress) hormones that are antagonistic to the actions of insulin (Minuchin, Rosman, & Baker, 1978). The second theory suggests that family factors, particularly supportive behaviors, affect diabetic control through their effect upon adherence (compliance) behavior.

The research conducted by Minuchin and colleagues supports the first theory. Diabetic adolescents were exposed to a stressful family interview and their physiologic responsiveness measured. Diabetic adolescents from families described by Minuchin as "psychosomatic" experienced a marked rise in free fatty acid levels in response to the stressful family interview, unlike diabetic adolescents from other types of families. Minuchin concluded that

the patients from the "psychosomatic" families had become over-involved in their parents' problems, enmeshed, and subsequently developed a hyperresponsive neuroendocrine system which led to frequent attacks of ketoacidosis. The adolescents in psychosomatic families who received structural family therapy experienced less problems with diabetic control as dysfunctional aspects of the family life were corrected. Results of this study as well as the studies using both animal models and human models are problematic because of questions about methodology, sample size, and design (Mengel, 1989).

Cross-sectional studies that examine the effect of the diabetic's family upon adherence behavior support the second theory. In a study by Schafer (1986), adolescents reported more negative family interactions than adults and were in poorer control. Hansen and colleagues (1984) performed a cross-sectional study on 93 adolescents with IDDM. They noted a near-significant association between family dysfunction and compliance behavior. Moreover, they noted that their measure of compliance behavior and stress were the two best predictors of diabetic control as measured by glycosylated hemoglobin. At the present time, no cohort or treatment studies exist which support the second theory.

Because of the lack of definitive research and continued controversy in this area, a small pilot study was constructed to examine the relationship between family factors and diabetic control. The pilot study was designed to examine physiologic stress and family factors as they relate to diabetic control.

In one phase of the pilot study, the adolescent and parents played a videogame, SIMFAM, developed by Dr. Stephen Spann. In this game, each participant is to place colored balls in the appropriate box but the rules for the game change with each game, thereby increasing stress for the participants. Physiologic stress measures including pulse and blood pressure were monitored throughout the videogame experience.

In addition, subjects did a family sculpture (Cromwell, Fournier, & Kvebaek, 1980) as individuals and as a family. This family sculpture technique permits family members to graphically depict on a grid their emotional relationship to each other by placing themselves in physical proximity to each other.

Analysis of data from this phase of the pilot study revealed several significant relationships. Adolescents who perceived their families as more cohesive had lower hemoglobin $A_1C$ levels and, hence, were in better diabetic control ($r=-.51$, $p<.10$). The more social support the adolescent perceived, the better the diabetic control ($r=-.55$, $p<.10$). The more disengaged the adolescent perceived the family, the poorer the diabetic control ($r=.52$, $p<.10$).

Some of the parental measurements were also significant. In particular, the more the mother perceived the family as dysfunctional the worse the diabetic control for the adolescent ($r=.50$, $p<.10$). The adolescent who perceived maternal behavior as non-supportive also was in worse diabetic control ($r=.52$, $p<.10$). However, the more positive the maternal feelings toward the adolescent, the better control the adolescent experienced ($r=-.65$,

$p<.05$). Similarly, the more the mother perceived that there were problems with the adolescent, the worse the diabetic control ($r=.52$, $p<.10$). The family sculpture revealed that the more discrepancy there was between the adolescents real and ideal patient-mother distance, the worse the diabetic control ($r=.54$, $p<.10$).

Adolescents whose fathers perceived the family as dysfunctional had poorer control of their diabetes ($r=.65$, $p<.05$). The more distance the father perceived between the mother-father relationship the better the diabetic control for the adolescent ($r=.60$, $p<.10$). Similarly, the greater distance the father perceived the ideal father-patient relationship, the better the diabetic control for the adolescent ($r=-.49$, $p<.10$).

The results of the physiologic stress research will be presented in more detail in another paper. More specifically, this paper focuses on the adolescent's perception of individual and family factors as they impact diabetic control for the adolescent.

## Conceptual Framework

Systems theory forms the conceptual framework for this pilot study. Von Bertalanffy (1968) defines a system as a complex of elements standing in interaction. Systems occur at multiple levels, from physiologic systems within the body that regulate glucose metabolism to human organizations called families. All systems have several things in common: (1) they serve a function that justifies their existence; (2) they may be opened or closed systems, depending upon whether they receive information from outside their boundaries; (3) they contain interaction patterns

called feedback loops that serve to regulate behavior in order to insure proper functioning; (4) they are homeostatic, meaning when one tries to change the functioning of a system, functioning often returns to its preintervention state because of feedback loops; and (5) systems are very resistant to change.

Family researchers utilize systems theory to study the functioning of the family system. Olson and colleagues utilized systems theory to develop the Circumplex Model of family systems. The two dimensions of this model are family cohesion, defined as an emotional bonding family members have toward one another, and family adaptability, defined as the ability of a family system to change its power structure, role relationships, and relationship rules in response to situational and developmental stress (Olson, Russell, & Sprenkle, 1983). In this model, families who function in the mid-range of the cohesion and adaptability continua are perceived as functional families. Families who are enmeshed or disengaged and rigid or chaotic are seen as dysfunctional.

Similarly, Hovestadt and colleagues (1985) utilized systems theory based upon the family therapy literature to develop an instrument that measures the health of the family of origin. In this paradigm, the healthy family develops intimacy by encouraging the expression of feelings, creating a warm atmosphere, dealing with conflicts without undue stress, promoting sensitivity in family members, and trusting in the goodness of human nature. Autonomy is developed by the family by emphasizing clarity of expression, personal responsibility, respect for other family

members, openness to others in the family, and by dealing openly with separation and loss.

The Bowen family systems theory (Kerr & Bowen, 1988) explains family dynamics and relationships between family members. Bowen claims that the triangle is the smallest stable relationship system and is the basic building block of any emotional system. The triangle, when calm, is made up of a comfortable and close twosome and a less comfortable outsider. The twosome works to preserve togetherness to prevent one from becoming uncomfortable and leaving the relationship. The outsider position is the most comfortable position in periods of stress. Each member of the twosome work to get to the outside position to escape the tension in the relationship. An unstable twosome can be stabilized by the emotional triangulation of a third person. Guerin and colleagues (1987) note the two primary functions of triangles with children are to cover over marital conflict and to let parenting become the issue around which marital conflict is organized. In one version of the triangle, one parent is overly close to and overinvolved with one or more children and the other parent is in the distant position. As the parents' anxiety about the marriage increases, the anxiety may be transmitted to the child and the child may become symptomatic.

Adolescence is a critical transition period between childhood and adulthood. Erikson (1968) provides a theoretical framework for understanding identity formation from which Adams and colleagues (1989) have conceptualized two dimensions of identity formation. These two dimensions involve the presence or absence of a crisis

period or continuum of exploratory behaviors, and the presence or absence of a clearly defined and stable commitment to values, standards and beliefs.

From these two dimensions, four categories of ego identity are identified. Adolescents who are referred to as identity diffused have not experienced the need to explore alternatives and subsequently may fail to establish ideological commitments. Youths who report stable commitments without a personalized crisis period are labeled identity foreclosed. These adolescents have accepted and taken ownership of the commitments of others, usually parents, without reshaping and modifying for individual fit. The third category includes adolescents who are experiencing the identity crisis and are actively exploring identities, but have not made a commitment. These youths are categorized as being in moratorium, a term utilized by Erikson (1968) to describe the adolescent ego identity period. Adolescents who have experienced a psychosocial moratorium, have made substantial exploration, then identified their unique and personal ideological commitments are labelled identity achieved.

Depression can occur during adolescence. Kandel and Davies (1982) estimate the incidence of self-reported depressed mood in adolescence at 18%. Several researchers have linked depression with adolescent suicide (Emery, 1983). The Beck Depression Inventory is the most frequently used self-report method of assessing severity of depression (Beck, et al, 1961). The scale is clinically derived and designed to measure attitudes and symptoms that appear to be specific to depression.

The model of family stress and adaptation developed by McCubbin and Patterson (1982) suggests that life stressors and strains result in a cumulative pile-up of demands upon family members. This pile up of changes is defined as the sum of normative and non-normative stressors and intra-family strains. These family life changes are additive and at some point reach a family's limit to adjust to them. When this occurs, the family system and/or its members will experience some negative consequences. Social support from others outside the family system can mediate the family's stress response to the pile-up of demands thereby reducing the impact of demands upon the family and/or helping the family adapt to the required change.

Based upon the review of the literature, an exploratory pilot study was designed to test the hypothesis that there is a relationship between the adolescent's perception of 1) adolescent development; 2) social support; 3) depression; 4) family dynamics including emotional health, functioning, and emotional triangulation; 5) stress; and 6) diabetic control. A conceptual model illustrates these hypothesized relationships. (See Figure 1).

## Method

This exploratory pilot study was conducted at the University of Oklahoma Health Science Center in the Department of Family Medicine. The study is a part of a larger pilot study funded by a grant from the National Institutes of Health to Dr. Mark Mengel. The study was reviewed and approved by the appropriate university institutional review committee.

Sample

The subjects for this study were recruited through physicians with patients with IDDM and advertisements in newspapers and the American Diabetes Association newsletters. Inclusion criteria were: 1) age 15 to 18 years; 2) insulin dependent diabetes mellitus for greater than one year; and 3) two non-diabetic parental figures present in the family. Exclusion criteria were; 1) pregnancy; and 2) IDDM for greater than ten years. These criteria were selected to control for the effect of puberty, pregnancy, initial adjustment to the diabetic regimen, and complications of diabetes.

A total of sixteen adolescents and parents were selected in the order of their response to the advertisements. No attempt was made to control for degree of diabetic control. Adolescents ranged in age from 14 to 18 (M 16 years). The 10 males and 6 females were primarily Caucasian (88%). Age of parents ranged from 35 to 56 years.

Design

After completing consent forms, the adolescent and parents completed a battery of questionnaires including sociodemographic information, medical history, and treatment history. A measure of diabetic control was obtained. Each subject completed the research packet independently so that confidentiality would be maintained.

Diabetic control. Glycosylated hemoglobin is one of several forms of hemoglobin A that form from the non-enzymatic attachment of glucose to the hemoglobin A molecule. The percentage of glucose to the hemoglobin $A_1C$ in a particular red blood cell depends upon the average glucose concentration to which that cell has been

exposed and the amount of time over which that exposure has occurred. The formation of hemoglobin $A_1C$ is reversible. Hence, levels fall only when red blood cells die and are replaced by cells with less glucose exposure. Hemoglobin $A_1C$ is the best available predictor of overall diabetic control over the previous two months (Abraham, et al, 1978).

Blood samples were taken from each adolescent and sent to a reference laboratory for hemoglobin $A_1C$ determination. The adolescent diabetic in good diabetic control can generally maintain their hemoglobin $A_1C$ level below 10%.

Family functioning. Family functioning was measured by utilizing the "real" form of FACES III (Olson, Portner, & Lavee, 1985). The twenty items in FACES III are scored on a 5-point Likert-type scale ranging from "almost never" to "almost always." Subjects are asked to describe how their families are now. The family cohesion dimension includes questions about emotional bonding, supportiveness, family boundaries, time and friends, and interest in recreation. The adaptability dimension includes questions about leadership, control, discipline, roles,and rules. Factor analysis supports the two dimensions. Reliability, using Cronbach alpha, is .77 for the cohesion scale and .62 for the adaptability scale. Norms for families with adolescents for the cohesion scale are 1) 10-31, disengaged; 2) 32-37, separated; 3) 38-43, connected; and 4) 44-50 enmeshed. Norms for this same sample for the adaptability dimension are: 1) 10-19, rigid; 2) 20-24, structured; 3) 25-29, flexible; and 4) 30-50, chaotic.

Family emotional health. Family emotional health is measured by the Family of Origin Scale (Hovestadt, et al, 1985.) This 40-item scale with a 5-point Likert-type response format measures perceived levels of autonomy and intimacy in the subject's family of origin. Reliability for the scale, using Cronbach alpha, is .75. The most healthy response receives a score of 5 and the least healthy response receives a score of 1. The highest possible total score is 200; the lowest possible total score is 40.

Emotional triangulation. The emotional triangulation scale is a new scale developed by the first author to measure emotional triangulation of the adolescent by parents when the parents are experiencing anxiety and conflict about their marital relationship (Lawler, 1989). The items in this scale measure the concepts of emotional boundaries, distracting behaviors, and interventions used by the adolescent. Reliability for the scale, using Cronbach's alpha, is .72.

Adolescent development. Adolescent development is measured by the extended version of the Objective Measure of Ego Identity Status instrument (EOMEIS) (Adams, et al, 1989). The 64 items in this instrument classify the subjects as either identity diffused, identity foreclosed, in moratorium, or as identity achieved based on the dimensions of ideological identity and interpersonal identity. Ideological identity includes occupational, religious, political, and philosophical life-style values, goals, and standards. Interpersonal identity incorporates aspects of friendship, dating, sex roles, and recreation choices.

Reliabilities of the instrument, using Cronbach alpha, range from .70 to .86.

Depression. Depression was assessed with the Beck Depression Inventory (Beck, et al, 1961). Each of the 21 items consists of four self-evaluative statements scored 0 to 3, with increasing scores indicating greater severity of depression. Scores between 0 and 9 indicate a normal nondepressed state, 10-15 reflects mild depression, 16-23 reflects moderate depression, and 24-63 reflects severe depression. Reliability and validity of this instrument is well documented (Strober, Green & Carlson, 1981).

Family stress. The pile-up of strains and stressors in the family was measured by the Family Inventory of Life Events and Changes (FILE) and, for the adolescent, the Adolescent-Family Life Inventory of Life Events and Changes (A-FILE) (McCubbin & Thompson, 1987). Both FILE and A-FILE assess life events and changes that have occurred in the family unit for the past year. In this study, the 71 items were scored so that a yes response received 1 point with the possible range of scores from 0 to 71 for each instrument. Overall reliability (Cronbach's alpha) for FILE is .72 and for A-FILE is .69.

Social Support. The Young Adult Social Support Inventory (YA-SSI) (McCubbin & Thompson, 1987) consists of 60 items that reflect five aspects of social support: emotional, esteem, network, appraisal, and altruistic. Subjects use a 3-point response format with "no", "yes", and "yes a lot." Scores are summed so that higher scores reflect more social support. Internal reliability for this instrument is .89 (Cronbach's alpha).

Analysis

Because of the sample size (N = 16), data analysis consists of descriptive statistics (See Table 1) and bivariate correlations. Scatter plots were done for each independent variable with the dependent variable to identify trends. A significance level of .10 was selected for the purpose of discussing significant relationships between variables.

Results

Hemoglobin $A_1C$ levels for the subjects in this study ranged from 7 to 19 (M=12). Three subjects had levels of 9 or below, indicating they were in good diabetic control. Seven adolescents had levels between 10 and 12. The remainder (N=7) had levels between 14 and 19, indicating poor diabetic control.

Scores of the adolescent's perception of family cohesion ranged from 19 to 46 (M=32). Six adolescents felt their families were disengaged, five felt they were separated, four felt they were connected and one felt that the family was enmeshed. When compared to norms reported by Olson (Olson, et al, 1985), a greater percentage of adolescents in this group fall in the disengaged category (37%) than Olson's group (18.6%). The percentage of adolescents in the separated category are similar for both this group and Olson's norm (31%). Approximately 25% of this group are in the connected category, while Olson reports 36%. Only one subject was in the enmeshed category (7%) as compared to Olson's report of 14.7%.

The adolescent's perception of the family's ability to adapt (adaptability) ranged from 13 to 34 (M=23). When compared to

Olson's norms, this group of adolescents scored more (5) in the rigid category (31%) than the norm (16%). Only 25% of this group felt their families were structured as compared to the norm of 37%. The percentage of adolescents in the flexible category (31%) and chaotic category (12.5%) are both similar to the norm.

Perception of emotional health of the family by the adolescents ranged from 75 to 160 (M=123). In this scale, the higher the score, the healthier the family. This instrument has been normed with college students and reports a mean score of 144. Based upon this mean, 15 of the 16 adolescents report their families as being less emotionally healthy than the college group. No norms are available for adolescents.

The subjects in this study scored between 14 and 29 on the emotional triangulation scale (M=21). Fifteen of the sixteen subjects were below the scale mean of 28, indicating that most of the subjects felt they were minimally triangled into their parental marital relationship.

Only one of the subjects in this study ranked in the diffused category in ego identity on the ideological dimension. Three adolescents scored in the foreclosed category and ten were in moratorium. The achieved category included two subjects. A larger number of subjects (4) were in the diffused category in the interpersonal identity dimension. Four students were foreclosed and eight were in the moratorium category. None of the subjects in this study were in the achieved category in the interpersonal identity dimension.

A great majority of the subjects in this study were not clinically depressed (87.5%). One subject scored as mildly depressed and one subject scored as severely depressed.

Normative data is available on the A-FILE for adolescents (M=7.66). The mean score for this group of adolescents was 8 with a range of 1 (low stress) to 15 (high stress). Only six of the adolescents scored below the mean. Thus, a majority of these adolescents (10) experienced moderate to high stress.

The mean score for the social support inventory (YA-SSI) for this group of adolescents was 71. In a study of college students, their mean score was 145. Scores in this study ranged from 32 to 146, indicating that this group of adolescents felt they received minimal social support from others.

Bivariate correlations were run between each of the independent variables and intervening variables, and between these variables and the dependent variable, diabetic control. Only those correlations statistically significant at the .10 level are reported (See Table 2).

Several variables were correlated with family functioning. Adolescent depression was negatively correlated with family cohesion ($r=-.53$, $p<.05$). Similarly, family emotional health was correlated positively with family cohesion ($r=.64$, $p<.05$). Social support and family cohesion were positively correlated ($r=.36$, $p<.10$). Adaptability was negatively correlated with emotional triangulation ($r=-.39$, $p<.10$). Both cohesion and adaptability were correlated ($r=.35$, $p<.10$), contrary to the reports of Olson and colleagues that these two measures are orthogonal.

Social support was positively correlated with family emotional health ($r=.46$, $p<.05$). Other variables in the conceptual model were not statistically significant at the .10 level. Yet, several were close to being significant. In particular, the correlation between family cohesion and stress was in the negative direction ($p=.12$). Similarly, the correlation between family adaptability and stress was in the negative direction ($p=.13$).

The only statistically significant correlation with the dependent variable, diabetic control, was with depression. Depression was positively correlated with diabetic control ($r=.51$, $p<.05$). Other variables correlated with diabetic control were not statistically significant, yet were in the predicted direction. For example, the correlation between diabetic control and family cohesion was in the negative direction as was the correlation between diabetic control, social support, and family emotional health.

## Discussion

Because of the preliminary nature of this study, it is premature to generalize to a larger population of diabetic adolescents and their families based upon this data. It is fruitful, however, to discuss relationships revealed in this study that need to be considered in providing care to the adolescent diabetic and family. Further areas of research need to be identified also.

It appears from this study that adolescents who are diabetic and live in families that are more cohesive are less depressed and experience less stressful life events. Similarly, it appears that

adolescents who perceive their families as more cohesive also perceive them as more emotionally healthy. However, adolescents who perceive their families as less flexible in their discipline and rules are more likely to be emotionally triangled into the parental marital relationship. In particular, it appears that adolescents who perceive themselves as depressed are also in poorer diabetic control.

These findings have important implications for the health professionals providing care to the adolescent diabetic. In particular, the relationship between depression and poor diabetic control must be considered. The relationship between depression in adolescence and suicide may place the diabetic adolescent at greater risk for suicide or suicidal gestures, such as forgetting to take insulin and not following dietary recommendations. The Beck Depression Inventory is a self-administered instrument that can be hand scored so would be easily available for practitioners to use for those adolescents who appear to have experienced mood changes.

Because of the small sample size, hypothesized relationships in the conceptual model could be investigated using only bivariate correlations. A larger longitudinal study needs to be conducted with not only diabetic adolescents and their families, but also with other adolescents with chronic disease as well as a normal sample of adolescents to identify differences, if any, in these factors and control of the chronic disease. Data analysis for this larger study would include path analysis and causal modeling using linear structural equations (LISREL). In particular, if causal

relationships can be identified through such research, intervention strategies can be identified and implemented at multiple levels of the family system. These interventions could be implemented by physicians, nurses, dietitians, counselors, and family therapists depending upon these causal relationships. Continued research in this area will provide more information that practitioners can use to assist the adolescent who has diabetes and the family to deal with this disease.

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Table 1. Scale Means and Standard Deviations (N=16)

| | Mean | S.D. |
|---|---|---|
| FACES III | | |
| Cohesion | 32.24 | 7.99 |
| Adaptability | 23.29 | 5.62 |
| Family of Origin | 123.5 | 19.47 |
| Emotional Triangulation | 21.06 | 4.01 |
| Beck Depression Inventory | 5.75 | 9.07 |
| Adolescent Family Inventory of Life Events | 8.00 | 4.05 |
| Young Adult - Social Support Inventory | 71.06 | 33.68 |
| Hemoglobin $A_1C$ | 12.18 | 3.32 |

Table 2. Statistically Significant Correlations

| | Family Cohesion |
|---|---|
| Depression | -.5325<br>p = .017 |
| Family Emotional Health | .6426<br>p = .004 |
| Social Support | .3632<br>p = .083 |
| Adaptability | .3580<br>p = .087 |

| | Family Adaptability |
|---|---|
| Emotional Triangulation | -.3857<br>p = .070 |

| | Social Support |
|---|---|
| Family Emotional Health | .4633<br>p = .035 |

| | Diabetic Control |
|---|---|
| Depression | .5069<br>p = .023 |

# Figure 1. CONCEPTUAL MODEL